NIST Combinatorial Methods Center

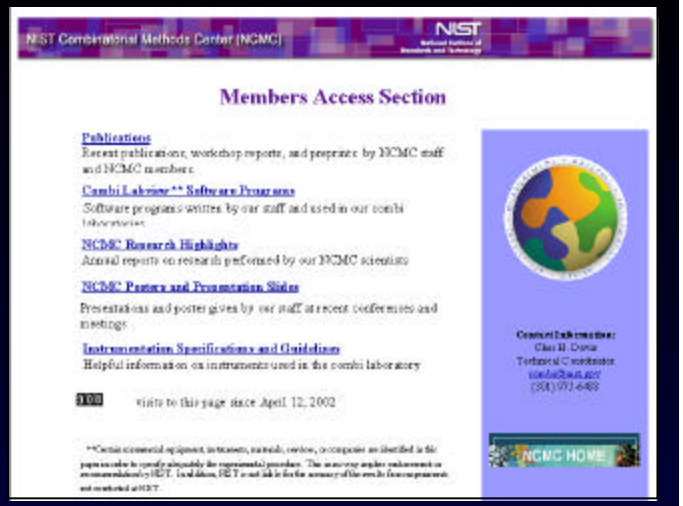
Overview of Members' Products and Services

Michael Fasolka	*Project Leader*
Cher Davis	*Technical Coordinator*
Alamgir Karim	*Group Leader*

Agenda

- NCMC Members' Products
  - Members' Web Site
  - Instrumentation Specification Documents
- Programs in Development
  - Informatics Infrastructure
  - Combi Methods for MEMs
- "Focused Project" Opportunity
  - High Throughput Interfacial Tension Measurements
- Feedback
  - Questions, Comments and Suggestions on NCMC Products

NCMC Members' Website
(www.nist.gov/combi)

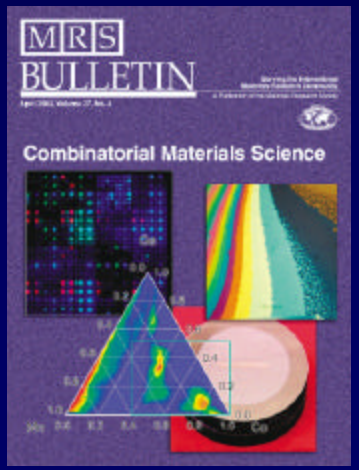


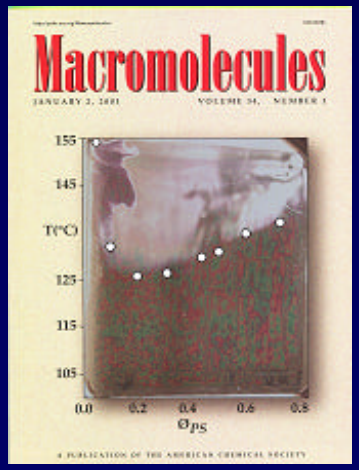
Sections:

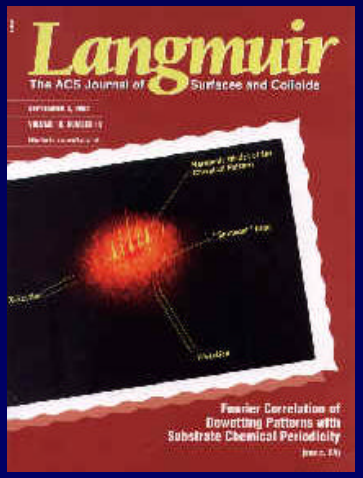
- Publications and *Preprints* Database

  An advance look at methods and data…

NCMC Combi Research	✓	*downloadable*
MSEL Combi Research	partial	*downloadable*
NIST-wide Combi Research	partial	*downloadable*
Selected papers from public domain	partial	some downloadable







Highlight:

Pattern-Directed Dewetting of Ultrathin Polymer Films

***Langmuir* 2002, *18*, 7041-7048**

Amit Sehgal, Vincent Ferreiro, Jack F. Douglas, Eric J. Amis, and Alamgir Karim

- # NCMC-produced Automation and Analysis Software

Build your custom software on a working example…

Software Downloads (Labview™ requires software license/hardware)

-UV/Ozone Gradient Automation (Labview™)

-Microscopy Automation (Labview™)

-Multilens Contact Adhesion Test Automation (Labview™)

-Gradient Flow Coating

-Composition Gradients

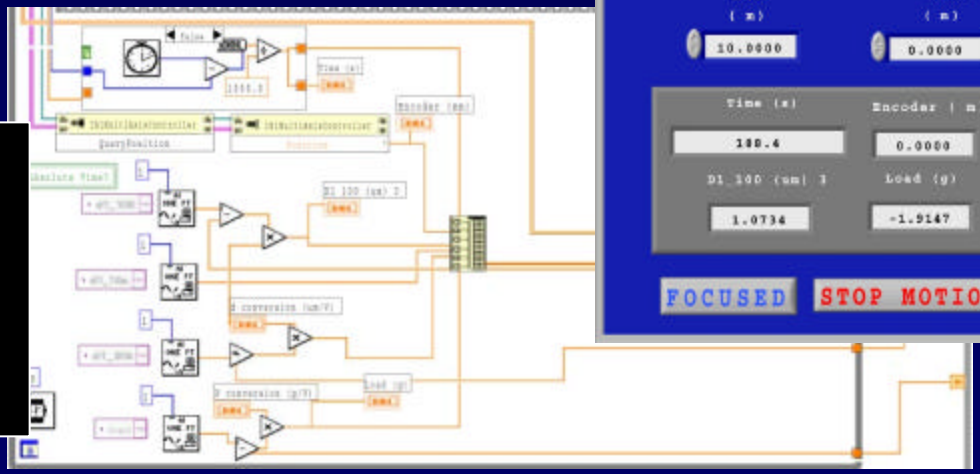
In Development:

-Batch Analysis Software (IDL, Igor)

-Flow Coater Mark II (Labview™)

-Better Documentation

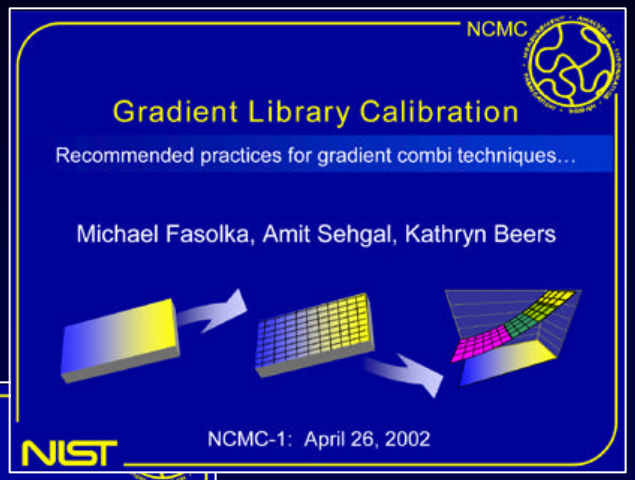
```
> ; Concatenate
>  M=LONG(NSAMP)*N
>  BIGGY=FLTARR(M)
>  K=N-1L
>  I1=0L
>  FOR I=0, NSAMP-1 DO BEGIN
>    BIGGY(I1:I1+K)=X
>    I1=I1+N
>  ENDFOR
```

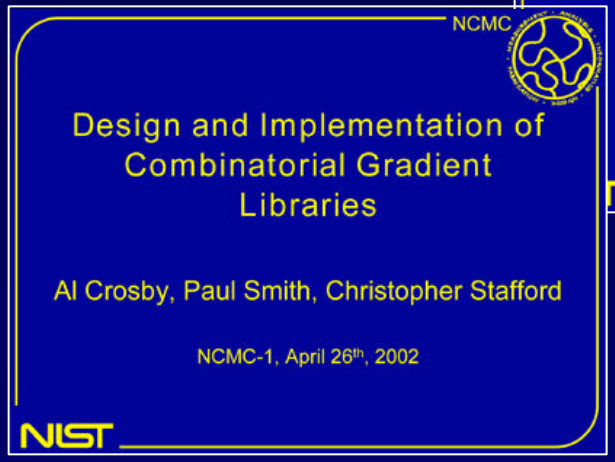


- Database of Presentation Materials

View our results, even if you can't make the meeting…

- NCMC Members' Symposia
  NCMC-1, All Future Workshops
- Conference Presentations
  APS, ACS, MRS, GRC
- Even Posters





Areas in Development

- Data Libraries
- Instructional Videos

Instrument Specifications Documents

Toolbox of Practical Knowledge for Combi Research…

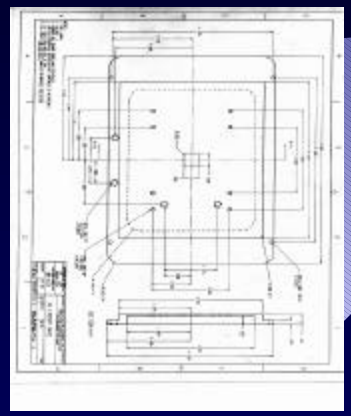
Details Beyond the Journal Publications

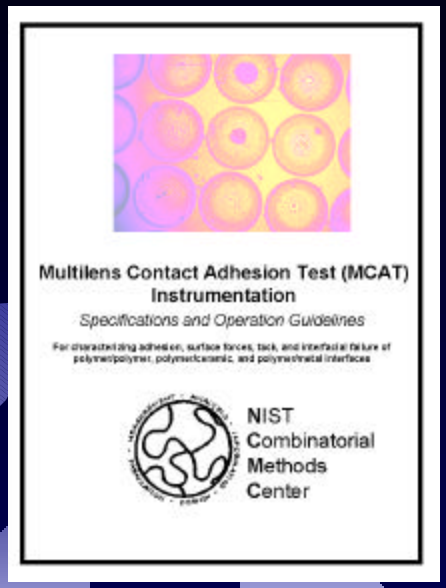
Limited Distribution to Members Through Website

Two Documents are Now Complete

- Multilens Contact Adhesion Test (MCAT)

  - Instrument schematics
  - Shop drawings
  - Component specifications
  - Background principles
  - Operation guidelines
  - Outlines of automation software

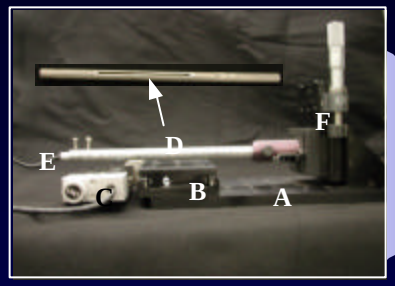


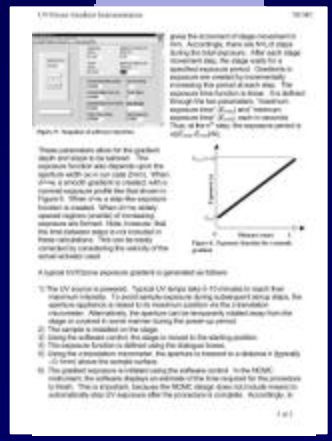


Instrument Specifications Documents

- UV/Ozone Gradient Instrumentation (UVOGI):

  - Instrument schematics
  - Detailed component specifications
  - Background principles
  - Operation guidelines
  - Calibration approaches
  - Outlines of automation software





4 more documents are in preparation:

  - Flow Coater/Flow Coater II
  - Microscopy Automation
  - SIEBIMM (Modulus Measurement)
  - Combi Copper Grid

A new practice for the NCMC

  - Like documents for all our future work.

NCMC is soliciting Member feedback on these documents

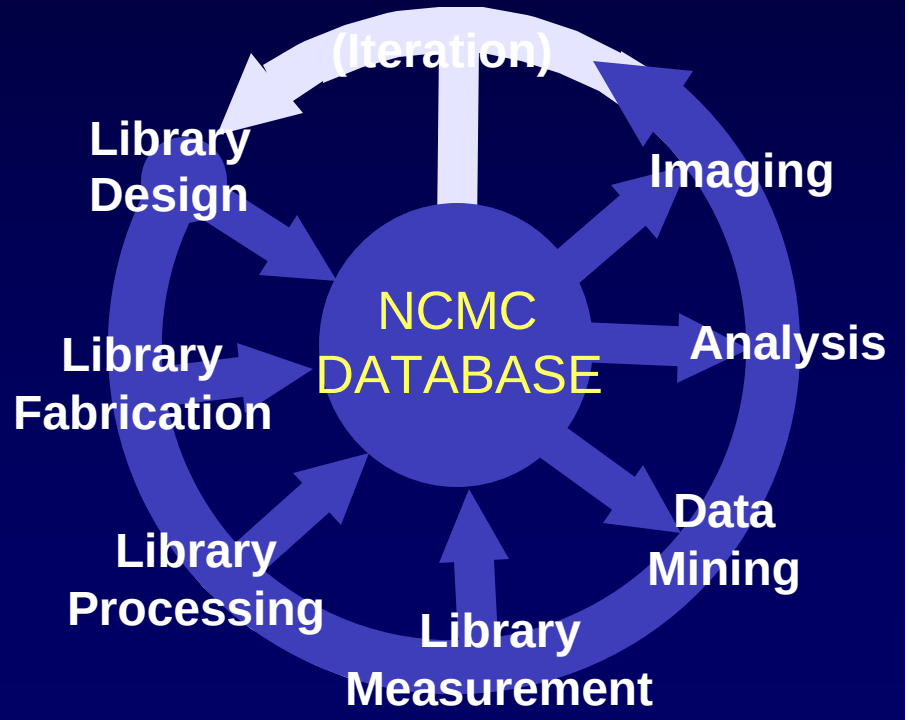
Programs in Development

- Informatics Infrastructure

  New Guest Researcher dedicated to NCMC infrastructure development: Dr. Wenhua Zhang (CUNY Staten Island, Dept. of Chem.)

  An informatics platform that streamlines our combinatorial workflow.

- **Consolidation of existing automation and analysis software**
- **Development of a centralized database system with these properties:**
  - **Open source code (Freely available to NCMC Members when done)**
  - **Network based**
  - **Object oriented, Image compatible**
  - **Interfaces with automation tools**
  - **Enables data-mining/versatile analysis of large combi data sets**
  - **E-notebook: Tracks specimen libraries through processing and measurement steps.**

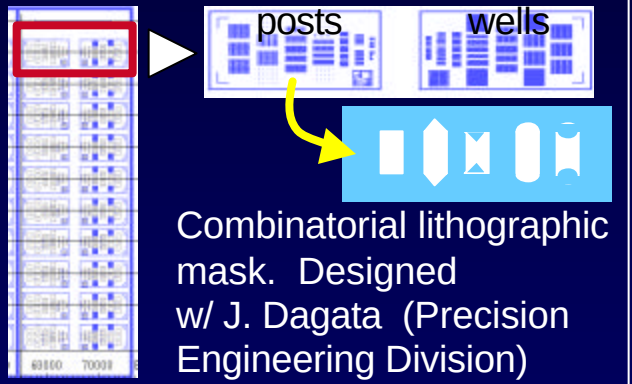


Combinatorial Methods for MEMs and Thin Film Devices

Combinatorial tools that foster the development of thin-film opto-electronics, photonic devices, MEMS and nanotechnology.

- Generally, MEMs devices have inherent topographic structure.
- Substrate topography is increasingly recognized as a means of directing and perfecting self-assembled structures for photonics, electronics.
- Combi techniques for examining substrate effects do not yet exist.
- Promise of peripheral technologies, e.g. Tools for soft lithography.

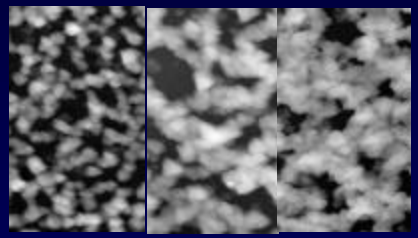
Patterned Topography



Combinatorial lithographic mask. Designed w/ J. Dagata (Precision Engineering Division)

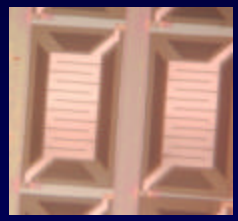
- Spacing, Scale and Shape
- Feature Height Gradients

Micro Roughness Gradients



- Calcined polymer/Spin-on-Glass blends.
- Roughness=f(ϕ, h)
- Solution cast via Flow Coating: gradients in ϕ & h

NIST MEMs Technology



Leverage existing tools. Foster NIST relationships.

- Expand MEMs Practice/Use
  - Combi/High Throughput aims
  - Further Develop Deposition
- In-situ Measurements
  - MHP Platform for Hot AFM

In Conjunction with Existing NCMC Techniques/Gradients/Instrumentation

Thickness, Surface Energy/Functionality, Composition, Adhesion/Failure, Mechanical Properties

- "Focused Project" Opportunity (Level 2 Membership)
- Collection of NCMC members contribute funds towards NIST research directed at a specific combi problem of common interest.

  <u>NCMC:</u>

  - Recruits and hires expertise in the appropriate fields.
  - Organizes and directs focused research based upon *non-proprietary*, but representative, model materials.
  - Disseminates results through quarterly workshops for participating members. (Ultimately, results will be published.)

  <u>Participating Members:</u>

  - Provide some funding. Amount will depend upon number of participants, labor required, and depth of proposed research.
  - Provide feedback and direction based upon results.

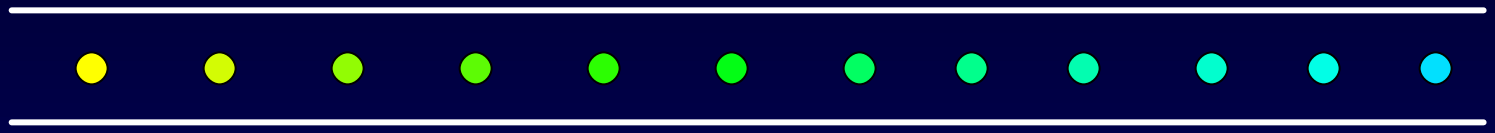
- # Focused Project:

Combinatorial Interfacial Tension Measurements

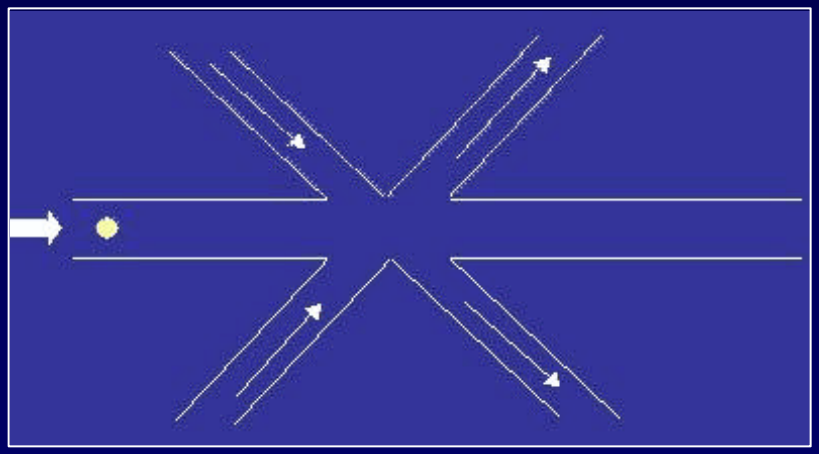
A combi tool for the prediction of stability, dispersion and viscosity in complex formulations

Strategy: A combination of gradient techniques and micro/milli- fluidics engineering…

Systematic variation in droplet composition:



Channel Design Creates Shear Flow



- Images of droplet deformation under known sheer conditions yield interfacial tension.
- Variations in droplet and matrix composition provide rapid exploration of parameter space.

Concept design by Steve Hudson and Kate Beers, Polymers Division

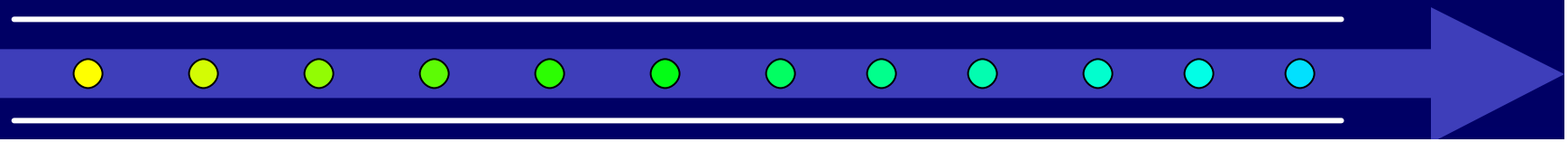
- Focused Project:

  Combinatorial Interfacial Tension Measurements

  First steps:

  1. NCMC gauges member interest in the project.
  2. NCMC outlines goals and strategy for research, assesses cost and determines fees.
  3. A formal announcement of the project and invitation to participate is issued.
  4. Resources are gathered.
  5. Research begins.

  If your company is interested in this project concept, please contact Alamgir Karim.
  (alamgir.karim@nist.gov, 301-975-6488)



Questions and Comments

- NCMC Members' Products
  - Members' Web Site
  - Instrumentation Specification Documents
- Programs in Development
  - Informatics Infrastructure
  - Combi Methods for MEMs
- "Focused Project" Opportunity
  - High Throughput Interfacial Tension Measurements

Thanks!